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Cremer

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(54) **CONTINUOUS FILLING DEVICE**

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USPC 53/247, 473, 500, 235, 251, 253; 141/145, 166–168; 198/441, 450, 198/459.2, 480.1, 481.1, 608, 624; 221/105
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,239,120 A 4/1941 Stewart et al.
2,540,120 A * 2/1951 Jacobs et al. 53/510
(Continued)

FOREIGN PATENT DOCUMENTS

CN 2725170 Y 9/2005
WO 95/02539 A1 1/1995

OTHER PUBLICATIONS

espacenet English abstract of CN 2725170Y.

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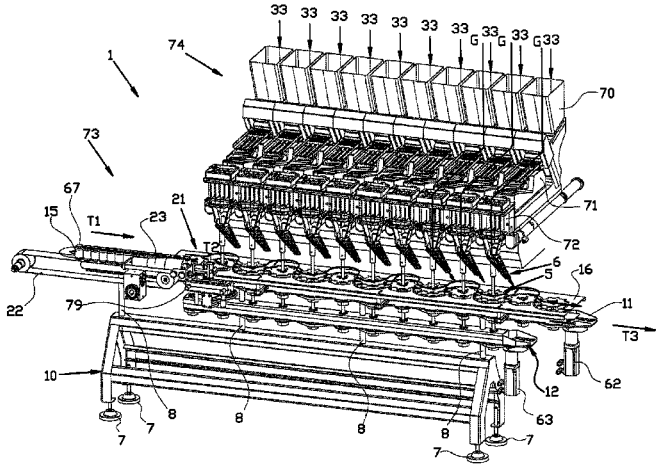
(57) **ABSTRACT**

Filling device (**1**) for filling packagings with counted bulk goods, comprising a dispenser (**74**) having several dispensing units (**33**) provided with a counter for counted dispensation of the bulk goods to the packagings and a conveying device (**73**) for transport of the packagings with respect to the dispensing units, wherein the conveying device is provided with several consecutive transport wheels (**5**) and a transport wheel drive for mutual opposite rotation of the immediately consecutive transport wheels, wherein the transport wheels each have a first axis of rotation and several packaging holders spread around the circumference, wherein the transport wheels with the axes of rotation parallel to each other and at the location of the packaging holders (**51**) are positioned in each other's vicinity for the transfer of packagings between packaging holders at a mutual transfer position between the immediately consecutive transport wheels during the opposite rotation for obtaining a meandering conveyance path of the packagings with respect to the dispensing units, which path is constituted of opposite arch segments.

14 Claims, 10 Drawing Sheets



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B65B 43/50	(2006.01)
B65B 43/60	(2006.01)
B65B 37/00	(2006.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,845,759	A *	8/1958	Cote et al.	53/495
3,028,713	A *	4/1962	Kennedy et al.	53/251
3,045,720	A *	7/1962	Jungmayr et al.	141/145
3,611,658	A *	10/1971	Dwyer	53/131.5
4,575,646	A *	3/1986	Saneski	326/29
5,058,634	A *	10/1991	Tisma	141/129
5,232,079	A *	8/1993	Belcastro et al.	198/370.11
6,701,973	B2 *	3/2004	Ikemoto	B65B 39/14 141/10
2002/0108356	A1	8/2002	Aylward	
2008/0168815	A1 *	7/2008	Coates	72/4
2009/0255948	A1 *	10/2009	Bassani	221/1

* cited by examiner

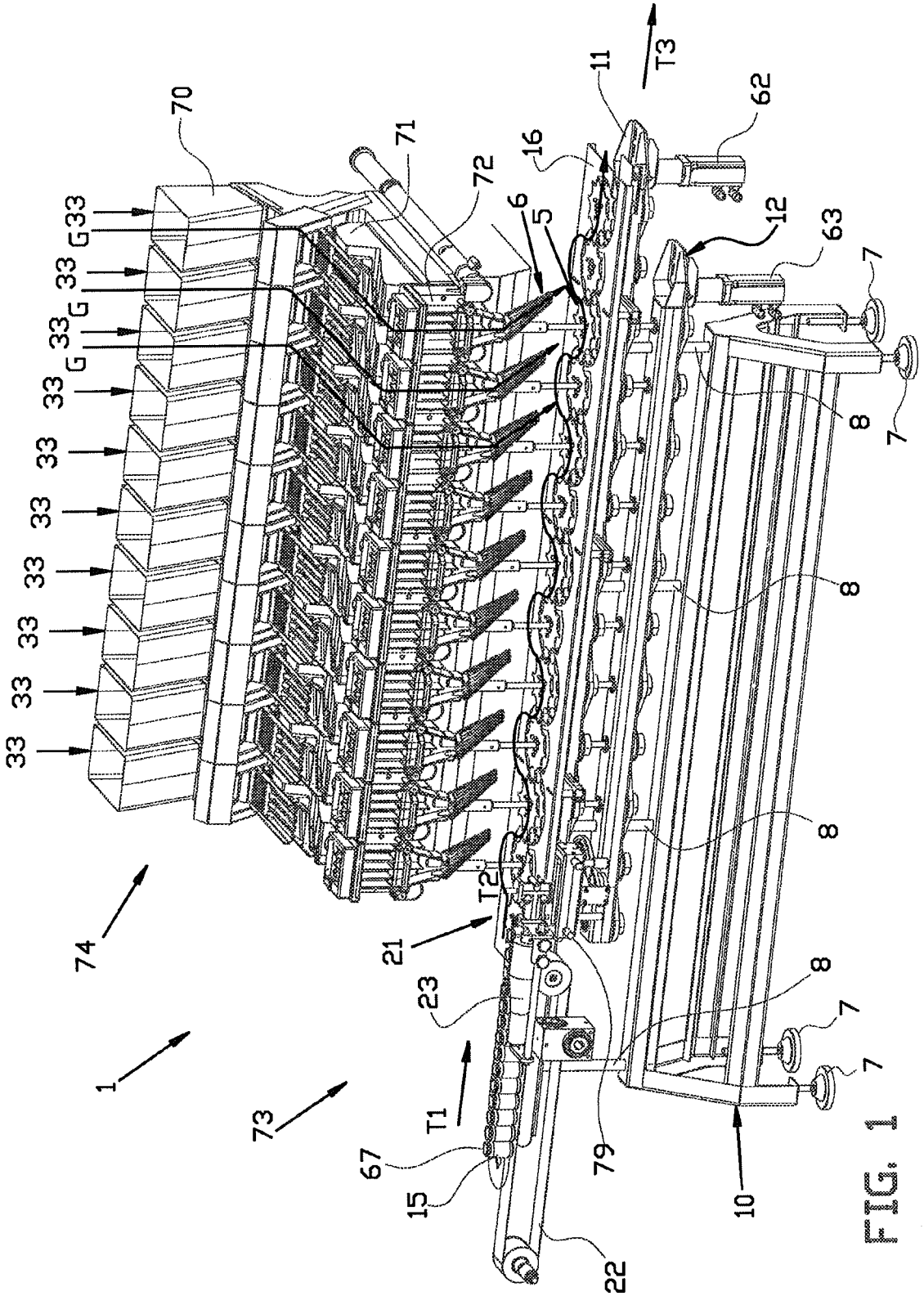


FIG. 1

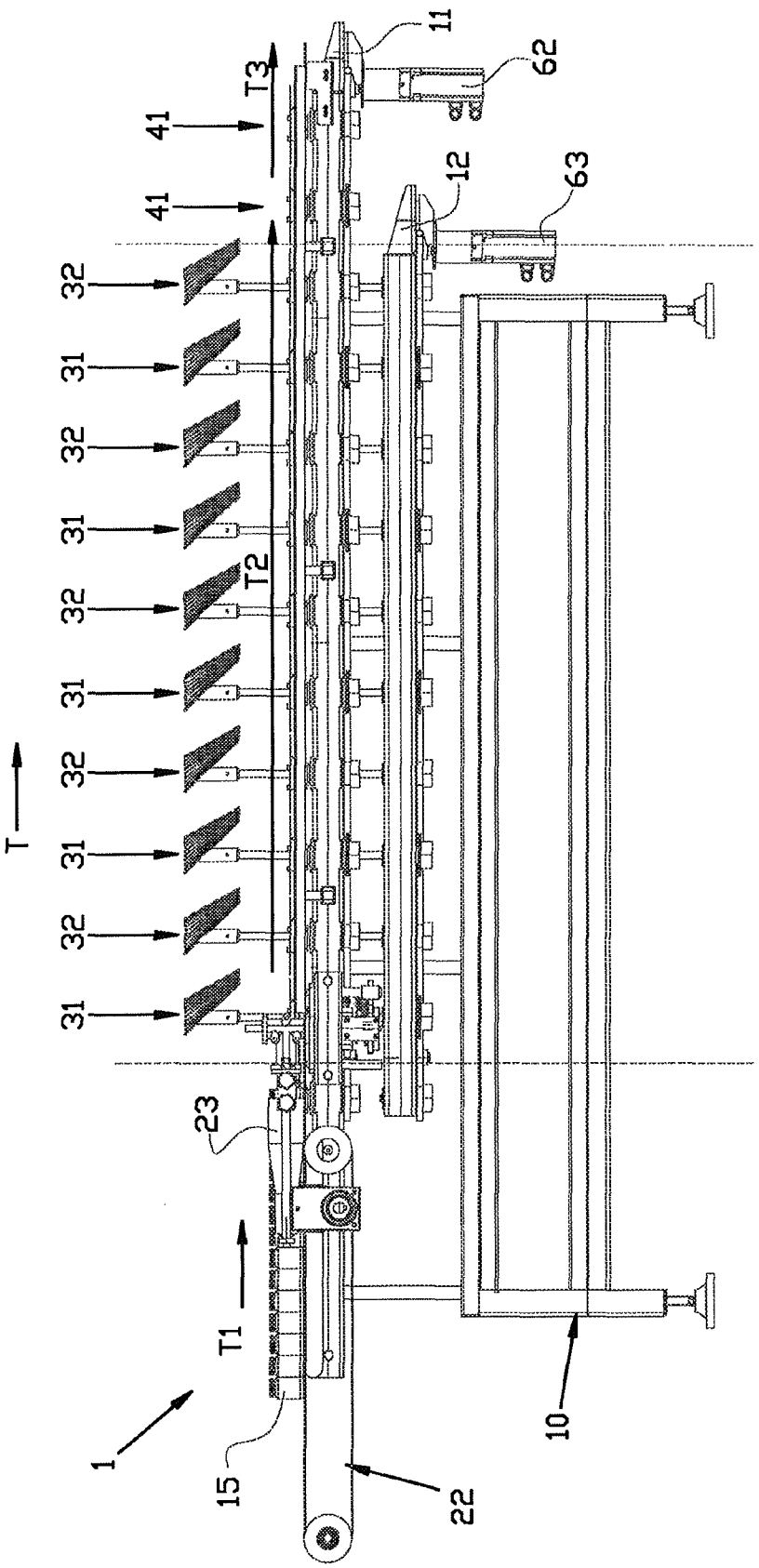


FIG. 2

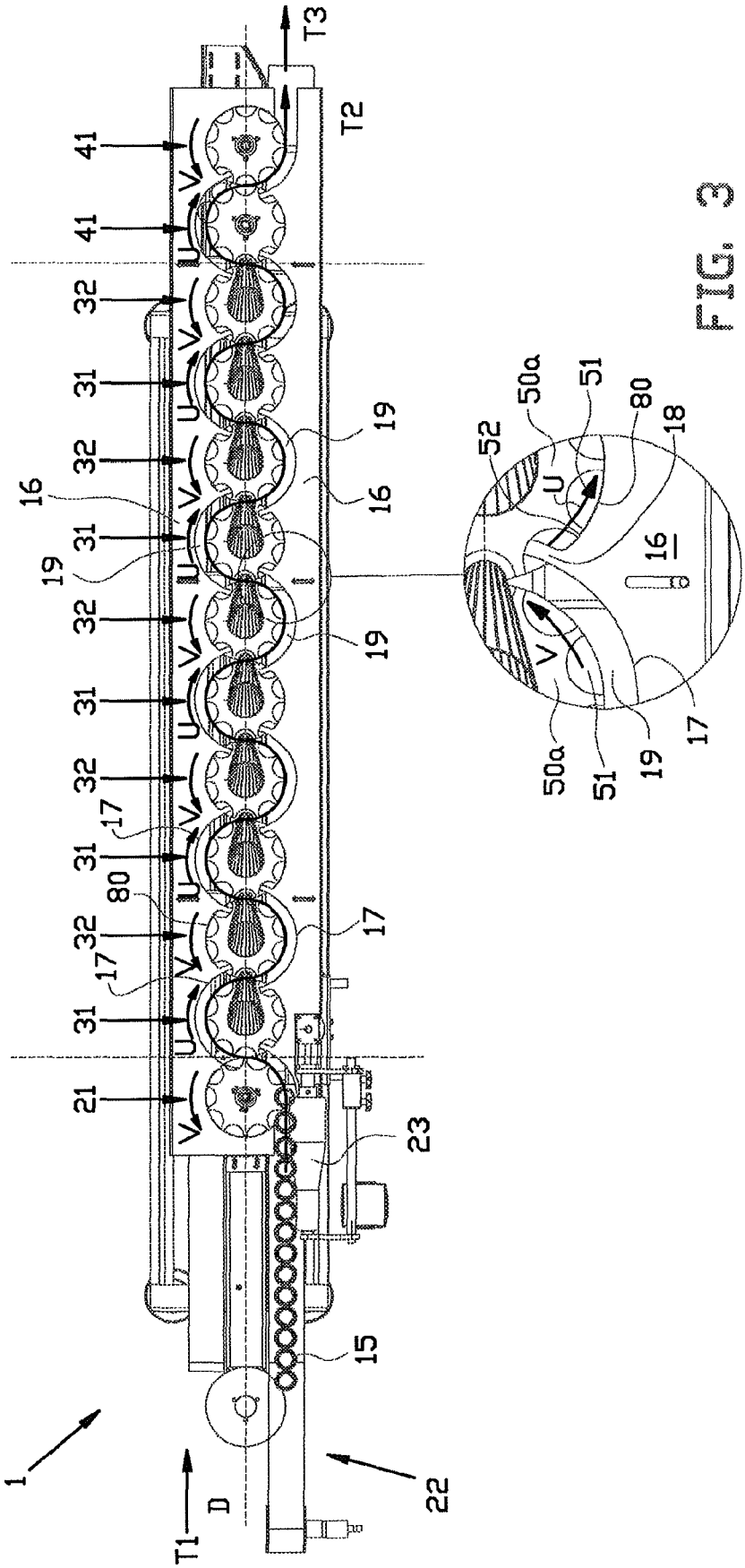
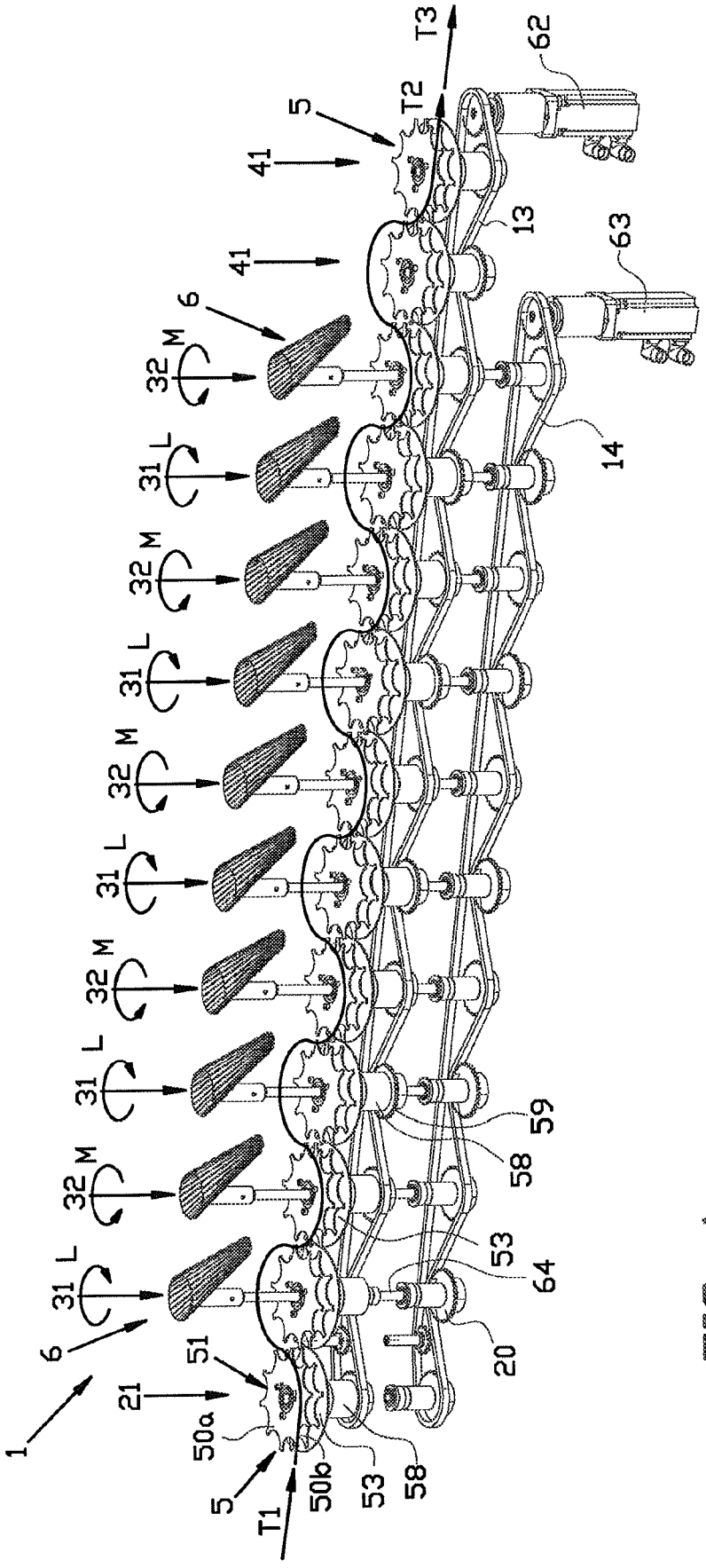

T3
T2
41
41
32
31
32
31
32
31
32
31
32
31
21
16
19
16
19
19
17
80
17
23
15
1
T1
D
22
50a
51
52
80
18
16
19
17
50a
51

FIG. 3


T3
62
T2
5
41
13
41
63
6
32 M
31 L
32 M
31 L
32 M
31 L
32 M
31 L
32 M
31 L
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64
20
6
51
21
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50a
5
T1
50b
53
58

FIG. 4

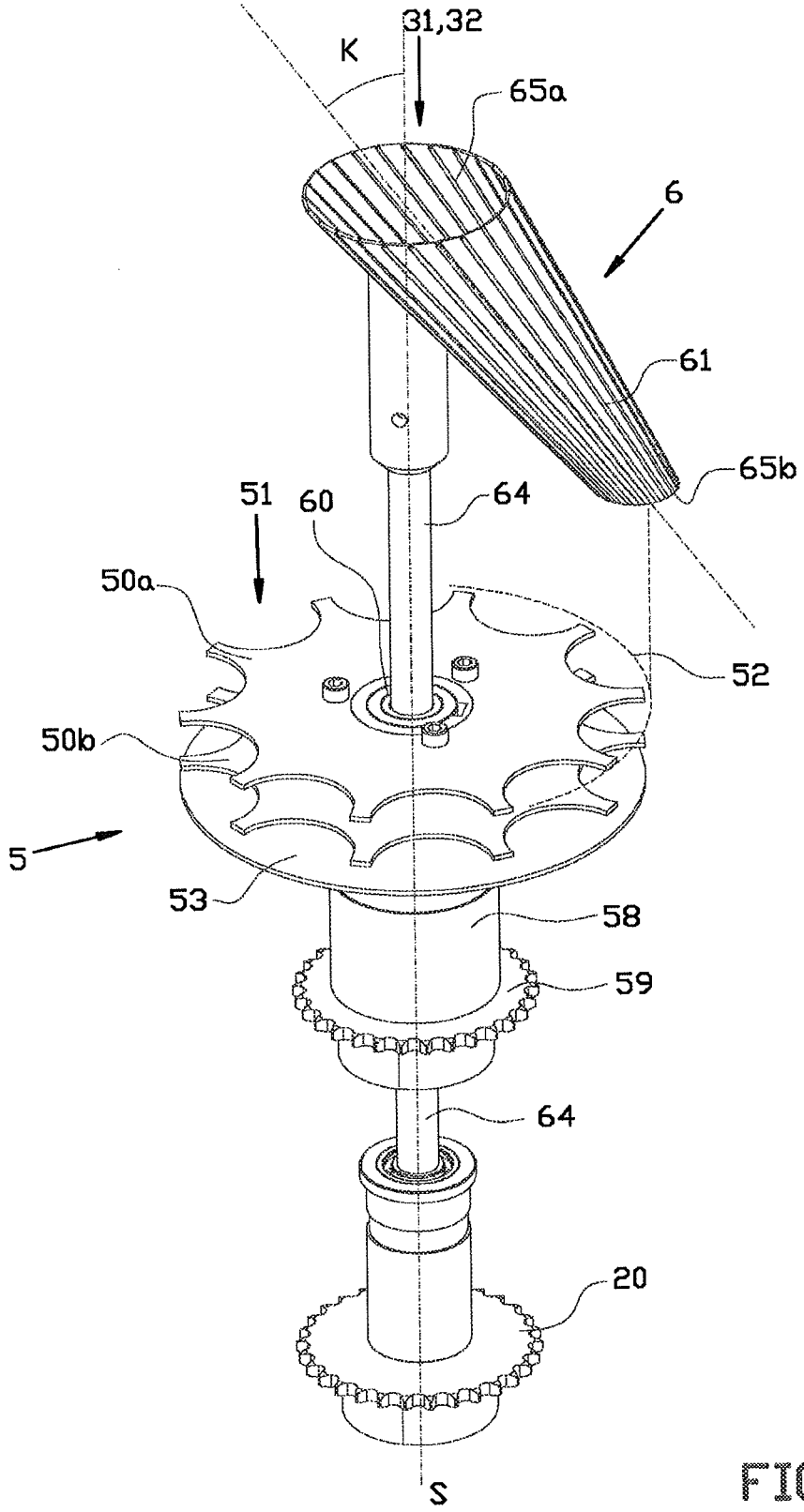

FIG. 5

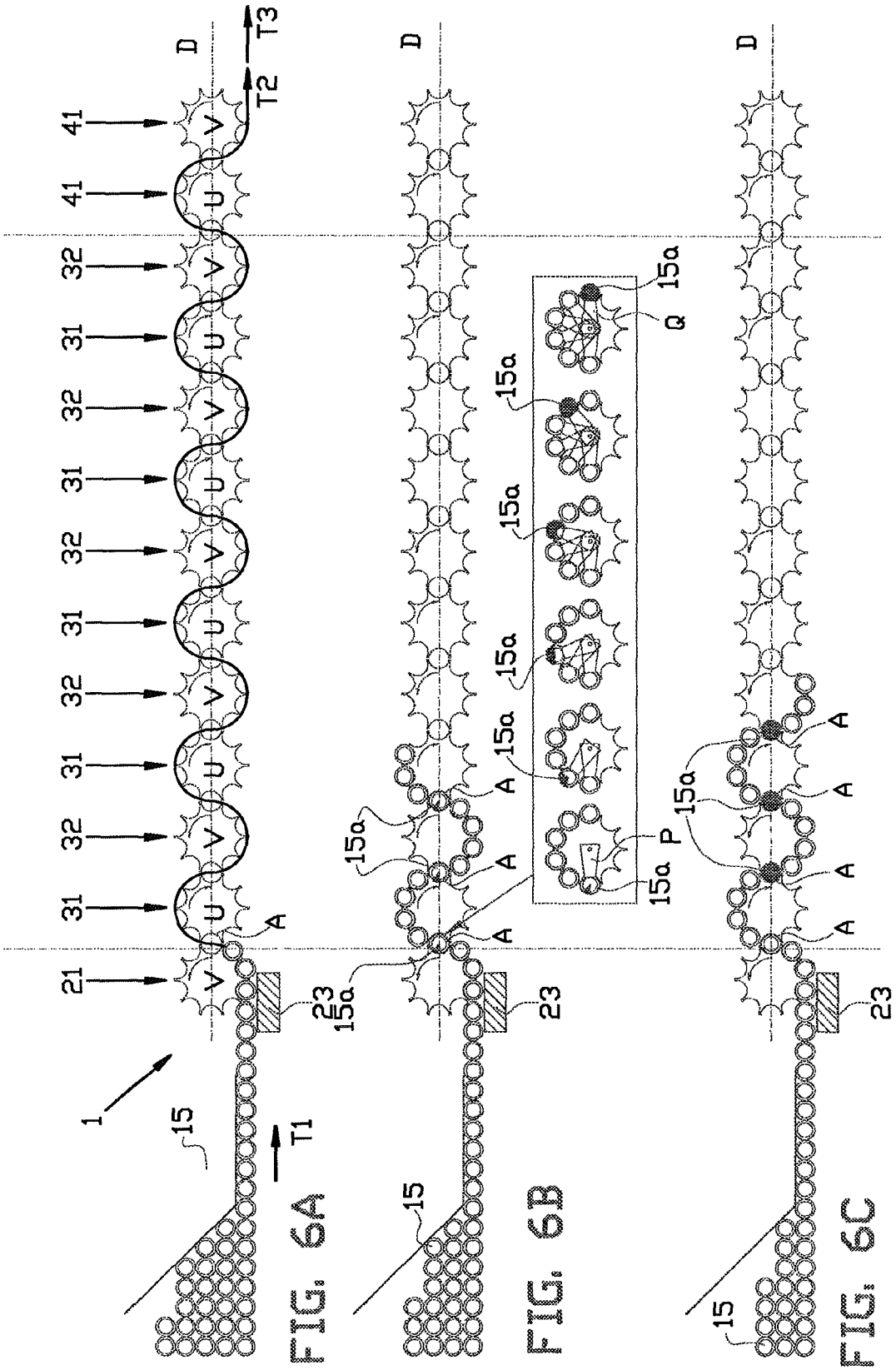

FIG. 6A FIG. 6B FIG. 6C

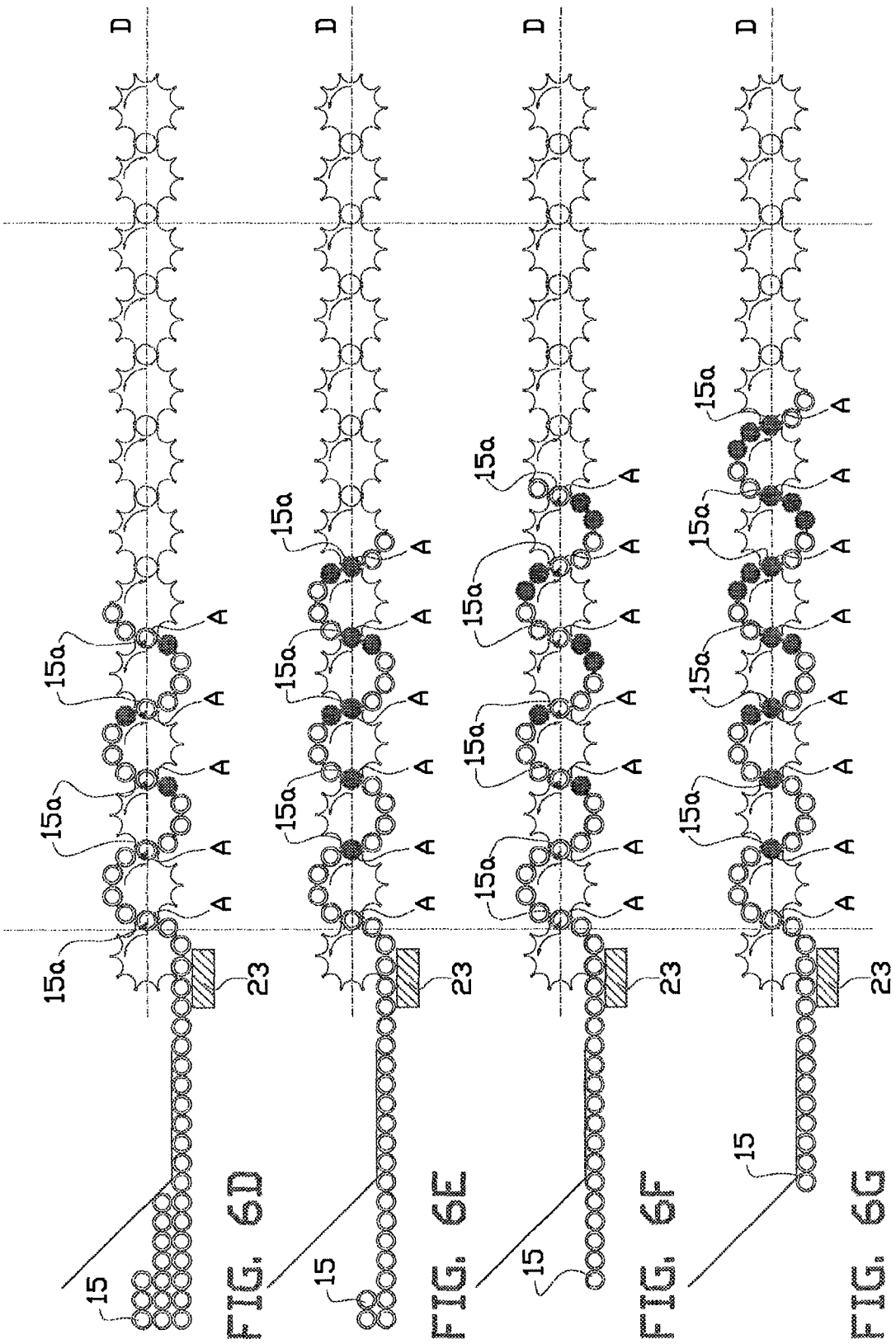

FIG. 6D FIG. 6E FIG. 6F FIG. 6G

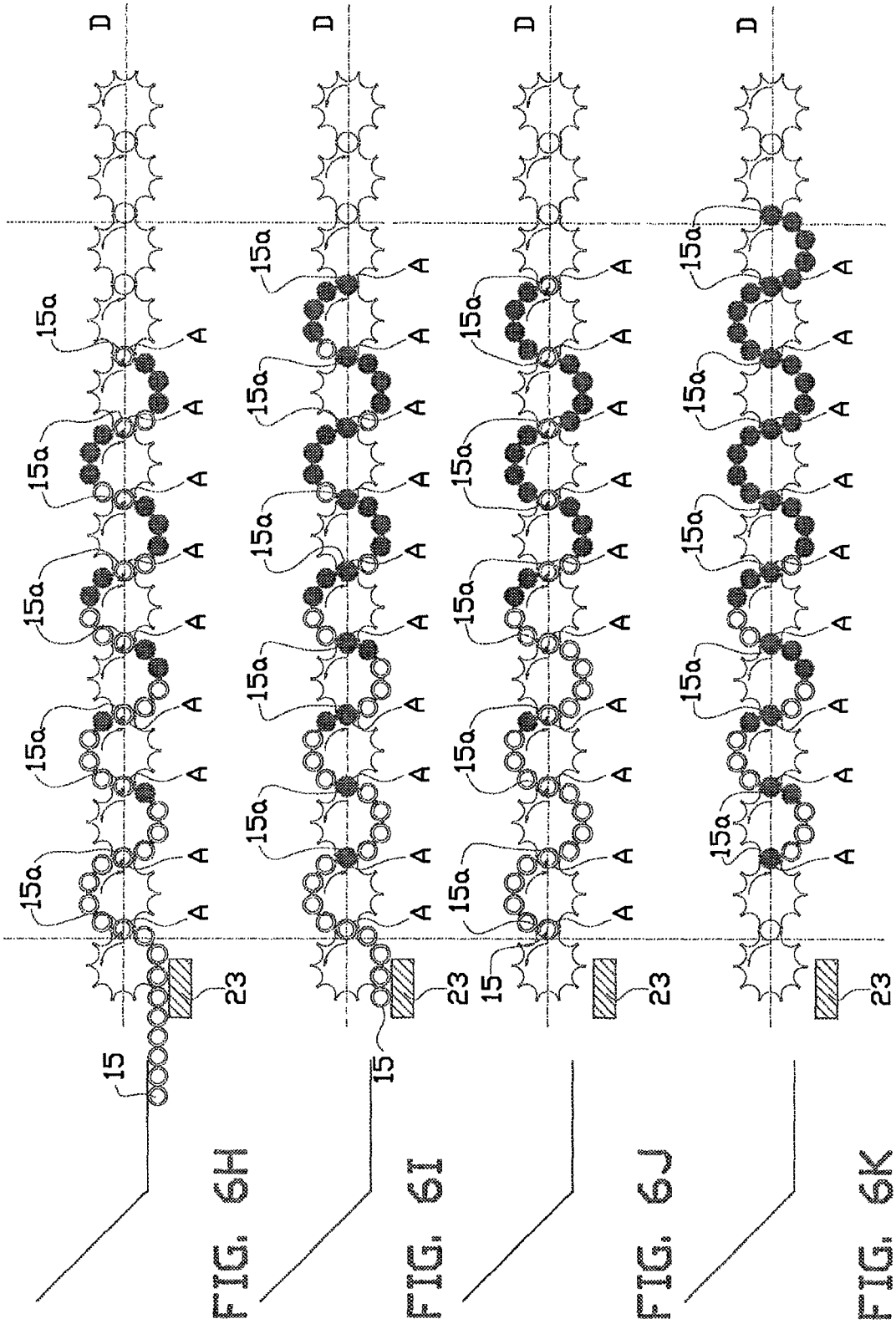

FIG. 6H

FIG. 6I

FIG. 6J

FIG. 6K

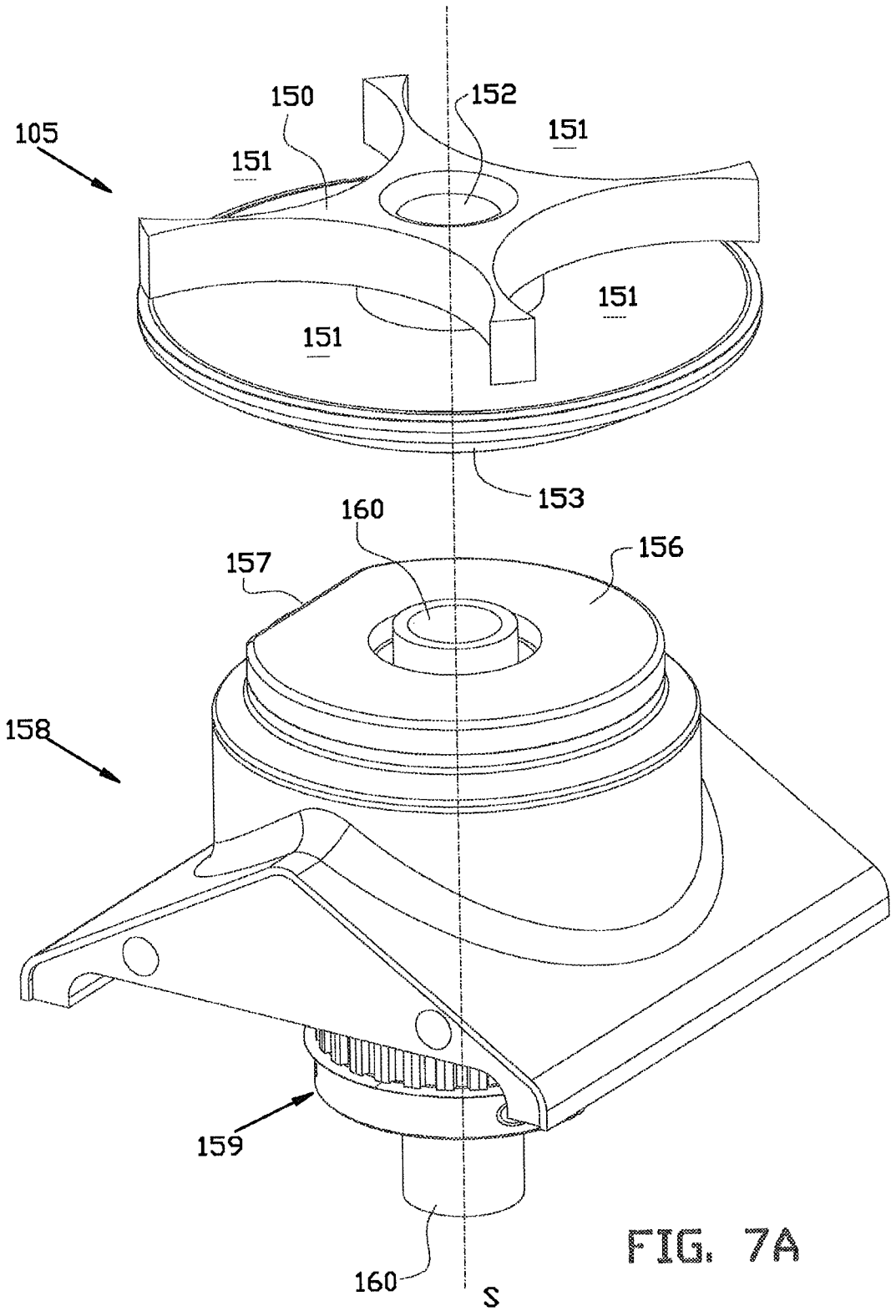

FIG. 7A

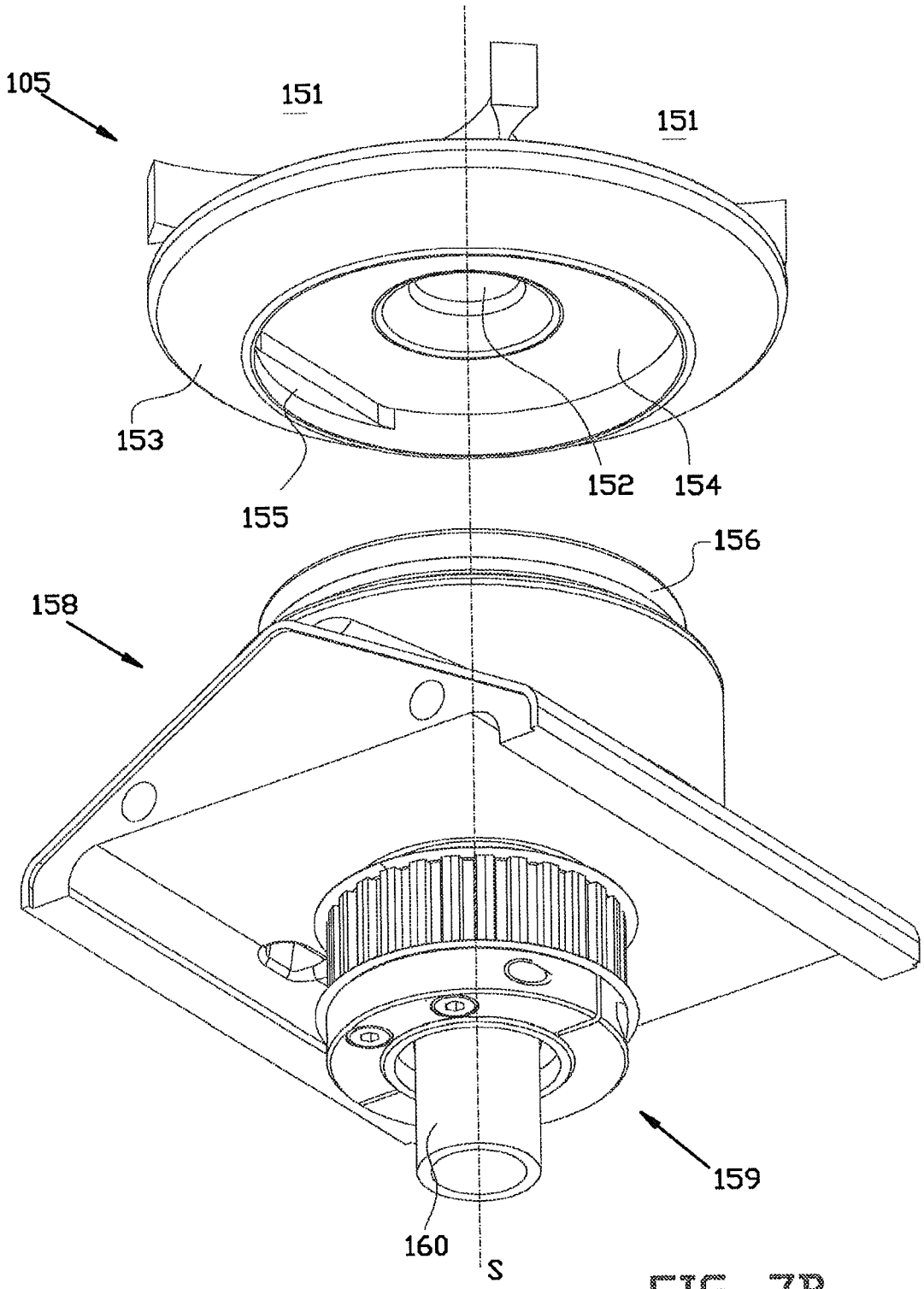

FIG. 7B

CONTINUOUS FILLING DEVICE

RELATED APPLICATION INFORMATION

This application is a 371 of International Application PCT/NL2010/050529 filed 24 Aug. 2010 entitled "CONTINUOUS FILLING DEVICE", which was published in the English language on 10 Mar. 2011, with International Publication Number WO 2011/028103 A1, and which claims priority from Netherlands Patent Application 2003428, filed 2 Sep. 2009.

BACKGROUND OF THE INVENTION

The invention relates to a filling device for filling packagings with bulk goods, such as for instance pharmaceutical capsules or tablets in the pharmaceutical industry.

A known filling device for filling packagings with bulk goods comprises a conveyor for rectilinear transport of the packagings and a dispenser having several dispensing units that are each provided with a counter positioned above the conveyor for simultaneously dispensing counted bulk goods to several transported packagings. During dispensing the bulk goods the packagings stand still underneath the counters. The conveyor is adapted for keeping packagings ready between the counters as well, which packagings are to be filled in a next counting session.

While the transport comes to a standstill and gets into motion again, thrusting forces are exerted on the packagings, as a result of which they may topple down or the bulk goods loosely accommodated therein may get damaged. The filled packagings also make starts and stops when the packagings kept ready are placed underneath the counters. The number of superfluous starts and stops increases as the filling device is expanded with several dispensers to achieve an intended discharge volume of filled packagings.

It is an object of the invention to provide a filling device for filling packagings with bulk goods which provides an efficient way of filling the packagings.

It is an object of the invention to provide a filling device for filling packagings with bulk goods of which the intended discharge volume of filled packagings can be adapted with little effect on the integrity of the bulk goods in the packagings.

SUMMARY OF THE INVENTION

According to a first aspect, the invention provides a filling device for filling packagings with counted bulk goods, comprising a dispenser having several dispensing units provided with a counter for counted dispensation of the bulk goods to the packagings and a conveying device for transport of the packagings with respect to the dispensing units, wherein the conveying device is provided with several consecutive transport wheels and a transport wheel drive for mutual opposite rotation of the immediately consecutive transport wheels, wherein the transport wheels each have a first axis of rotation and several packaging holders spread around the circumference, wherein the transport wheels with the axes of rotation parallel to each other and at the location of the packaging holders are positioned in each other's vicinity for the transfer of packagings between packaging holders at a mutual transfer position between the immediately consecutive transport wheels during the opposite rotation for obtaining a meandering conveyance path of the packagings with respect to the dispensing units, which path is constituted of opposite arch segments.

The conveying device provides a meandering path in which the packagings can remain continuously and evenly in motion. The number of dispensing units can as a result be adjusted to the intended discharge volume of the filling device while the effect on the integrity of the counted bulk goods in the packagings remains the same.

In one embodiment consecutive transfer positions between consecutive transport wheels are situated on a first straight line. In an as regards structure advantageous manner, said dispensing units can also be positioned according to a parallel straight line.

In one embodiment the first axes of rotation of consecutive transport wheels are situated on a second straight line, so that the transport wheel drive can remain simple as regards structure.

In one embodiment the first line and the second line coincide with each other, as a result of which the opposite arch segments of the meandering conveyance path can have substantially the same length.

In one embodiment the first axes of rotation are substantially vertically oriented and the meandering conveyance path extends in a substantially horizontal straight plane, as a result of which accelerations of the packagings and the bulk goods in vertical direction can be counteracted.

In one embodiment the meandering conveyance path is constituted of opposite segments of an arc of a circle, as a result of which the centrifugal forces on the packagings and the bulk goods can remain constant to a large extent.

In one embodiment the meandering conveyance path is constituted of opposite substantially half arcs of a circle.

In one embodiment the packaging holders coming together at the transfer position enclose a packaging on both sides, so that the packaging toppling over specifically during the transfer between the transport wheels can be counteracted.

In one embodiment the transport wheels have an outer circumference situated on a circle at which outer circumference the packaging holders are situated.

In one embodiment thereof the packaging holders are adapted for at least partially enclosing the packagings within the outer circumference of the transport wheels.

In one embodiment the packaging holders are adapted for partially keeping the packagings outside of the outer circumference, so that already prior to the transfer they are ready to be engaged.

In one embodiment at the location of the transfer position the conveying device is provided with a first guide for imposing the transfer of a packaging at the transfer position between packaging holders of the consecutive transport wheels, which holders come together at the transfer position. The transfer can then take place reliably, as a result of which it is counteracted that the transferring packaging holder remains occupied.

In one embodiment the conveying device comprises a second guide between consecutive transfer positions for keeping the packagings confined in the packaging holders.

In one embodiment that can be properly cleaned by machine, the transport wheels are constituted of a circular bottom disc and a transport disc fixedly positioned above it, wherein the packaging holders are formed with recesses formed at the circumference of the transport disc and the portions of the bottom disc that are situated straight below the recesses.

The transport wheels can easily be removed, for instance to be cleaned, when the transport wheels are detachably magnetically connected to or magnetically locked with respect to the transport wheel drive.

In one embodiment the transport wheel drive comprises a transport wheel support having an electromagnet that can be switched on and off for connecting or locking the transport wheels with respect to the transport wheel drive. The connection or the locking can be effected and ended easily by switching the electromagnet on and off.

In one embodiment the transport wheel drive is adapted for synchronised opposite rotation of the immediately consecutive transport wheels at the same speed of revolution and per revolution with the same packaging holders at the transfer position, so that the transport process can be repeated infinitely for filling large quantities of packagings.

In one embodiment the conveying device is provided above at least a part of the transport wheels with a slide per transport wheel, which slide is positioned at a slant and has a second axis of rotation and a lower exit for the transfer of counted bulk goods from the dispensing units to the packagings, wherein the conveying device comprises a slide drive for mutual opposite rotation of the in accordance with the transport wheels immediately consecutive slides for with the lower exit following a packaging moving away from the transfer position, which packaging is in a packaging holder of said transport wheel. Filling the packagings can then take place during transport between consecutive transfer positions.

In an embodiment that is advantageous as regards structure, the first and second axes of rotation coincide with each other.

In one embodiment the slide drive is adapted for synchronised opposite rotation of the in accordance with the transport wheels immediately consecutive slides at the same speed of revolution and with the same starting position with respect to the transfer position. During transport the filling process of the packagings can then be repeated infinitely for filling large quantities of packagings.

In one embodiment the height of the lower exit of the slide is adjustable with respect to the packaging holders, so that packagings of various heights can be filled.

In one embodiment the conveying device at the location of one or several last transport wheels is provided with a separation device for removing disapproved packagings from the meandering path, so that only the appropriately filled packagings are transported onwards for further processing, such as applying unique labels per packaging.

According to a second aspect the invention provides a method for filling packagings with counted bulk goods using a filling device, wherein the filling device comprises a dispenser having several dispensing units provided with a counter for counted dispensation of the bulk goods to the packagings and a conveying device for transport of the packagings with respect to the dispensing units, wherein the conveying device is provided with several consecutive transport wheels and a transport wheel drive for mutual opposite rotation of the immediately consecutive transport wheels, wherein the transport wheels each have a first axis of rotation and an even number of packaging holders spread around the circumference, wherein the transport wheels with the axes of rotation parallel to each other and at the location of the packaging holders are positioned in each other's vicinity for the transfer of packagings between packaging holders at a mutual transfer position between the immediately consecutive transport wheels during the opposite rotation for obtaining a meandering conveyance path of the packagings with respect to the dispensing units, which path is constituted of opposite arch segments, wherein the transport wheel drive is adapted for synchronised opposite rotation of the immediately consecutive transport wheels at the same speed of revolution and per revolution with the same packaging holders at the transfer position, wherein the conveying device above at least a part of the transport wheels is provided with a slide per transport wheel, which slide is positioned at a slant and has a second axis of rotation and a lower exit for the transfer of counted bulk goods from the dispensing units to the packagings, wherein the conveying device comprises a slide drive for mutual opposite rotation of the in accordance with the transport wheels immediately consecutive slides for with the lower exit following a packaging moving away from the transfer position, which packaging is in a packaging holder of said transport wheel, wherein the slide drive is adapted for synchronised opposite rotation of the in accordance with the transport wheels immediately consecutive slides at the same speed of revolution and with the same starting position with respect to the transfer position, wherein the conveying device per dispensing unit comprises a transport wheel and a slide and consecutive transfer positions between consecutive transport wheels are situated on a first straight line, wherein the method comprises repeatedly entering a series of packagings in the packaging holders of the first transport wheel positioned below a slide at the location of the first straight line, wherein the series is built up from several sub series and the slides per sub series move along with a packaging holder so as to rotate away from the transfer position and the dispensing units dispense a counted dose of bulk goods, wherein the size and composition of the series in sub series depending on the number of packaging holders per transport wheel and depending on the number of transport wheels positioned below a slide is determined as follows:

i) the number of sub series within the repetitive series equals the number of transport wheels positioned below a slide divided by two.

ii) the overall number of packagings of the repetitive series equals the number of packaging holders per transport wheel multiplied by the number of transport wheels positioned below a slide divided by two.

iii) if the number of sub series is an even number and if the number of transport wheels positioned below a slide is an even number, then the sub series each consist of a number of packagings equaling the overall number of packagings minus the number of sub series within the series divided by the number of sub series within the series, wherein a number of packagings equaling the number of sub series within the repetitive series is added to the first sub series of the series.

iv) if the number of sub series is an odd number and if the resulting number of a division of the transport wheels positioned below a slide by the number of sub series within the series results in an integer, the sub series each consist of a number of packagings equaling the overall number of packagings minus the number of sub series within the repetitive series, overall divided by the number of sub series within the repetitive series, wherein the number of packagings equaling the number of sub series within the series is added to the first sub series of the series.

v) in all other cases the sub series each consist of a number of packagings equaling the overall number of packagings of the repetitive series divided by the number of sub series within the repetitive series.

The numbers of packagings in the consecutive sub series are chosen such that the packagings in the transfer positions after entering a sub series are empty and ready to be able to be filled with bulk goods that are supplied from the dispensing units via the slides.

In one embodiment the filling device comprises several exchange sets of identical transport wheels of which the number of packaging holders per transport wheel per set is different, wherein the method comprises prior to filling placing an

exchange set in the conveying device and filling packagings according to the above-mentioned stipulations.

According to a third aspect the invention provides a filling device for filling packagings with counted bulk goods, comprising a dispenser having several dispensing units provided with a counter for counted dispensation of the bulk goods to the packagings and a conveying device for transport of the packagings with respect to the dispensing units, wherein the conveying device is provided with several consecutive transport wheels and a transport wheel drive for mutual opposite rotation of the immediately consecutive transport wheels, wherein the transport wheels each have a first axis of rotation and several packaging holders spread around the circumference, wherein the transport wheels are detachably magnetically or electromagnetically connected to or magnetically locked with respect to the transport wheel drive. The transport wheels are easily detachable for cleaning or exchange with other transport wheels.

In one embodiment the transport wheel drive comprises a transport wheel support having an electromagnet that can be switched on and off for connecting or locking the transport wheels with respect to the transport wheel drive. The connection or the locking can easily be effected and ended by switching the electromagnet on and off.

In an embodiment that is advantageous as regards structure, the transport wheel comprises a transport disc and a bottom disc that are integrally formed.

The aspects and measures described in this description and the claims of the application and/or shown in the drawings of this application may where possible also be used individually. Said individual aspects may be the subject of divisional patent applications relating thereto. This particularly applies to the measures and aspects that are described per se in the sub claims.

SHORT DESCRIPTION OF THE DRAWINGS

The invention will be elucidated on the basis of a number of exemplary embodiments shown in the attached schematic drawings, in which;

FIG. **1** shows an isometric view of a filling device according to the invention;

FIGS. **2** and **3** show a front view and a top view, respectively, of the filling device of FIG. **1**;

FIGS. **4** and **5** show isometric views of details of the filling device according to FIG. **1**;

FIG. **6**A-K show a schematic view of the operation of the filling device according to FIG. **1**; and

FIGS. **7**A and **7**B show isometric views of alternative parts for the filling device according to the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a filling device **1** for filling packagings with bulk goods. In this example the packagings are pots **15** provided with a filling opening **67** which pots are filled from above with pharmaceutical tablets. The filling device **1** comprises a dispenser **74** and a conveying device **73** that will be discussed below in detail.

As shown in FIG. **1** the dispenser **74** in this example comprises ten adjacently positioned dispensing modules **33**, each comprising a filling bunker **70**, a vibration mechanism **71** for horizontally transporting the tablets out of the filling bunker **70** over vibrating troughs (not shown) and a counter **72** for counting and dispensing the tablets discharged by the vibrating troughs. The path of one tablet is schematically shown with arrow G.

As shown in FIGS. **2** and **3** the conveying device **73** comprises an underframe **10**, which is placed on a level basis by means of four legs **7** and an elongated first horizontal frame **11** that is fixedly connected to the underframe **10** by means of four vertical supports **8**. As shown in FIGS. **3** and **4**, the conveying device **73** according to a straight row is provided with one input conveyor **21**, ten transit conveyors **31**, **32** which are each positioned below a counter **72** of the dispensing modules **33**, and two output conveyors **41**. As shown in FIG. **5** said conveyors **21**, **31**, **32**, **41** each comprise a first bearing housing **58** that is fixedly connected to the first frame **11**, a hollow shaft **6**D bearing mounted within the bearing housing **58**, which hollow shaft has a vertical centre line and an axis of rotation S, a first toothed wheel **59** rotation-fixedly connected to the hollow shaft **60** at the lower side of the first bearing housing **58**, and a transport wheel **5** rotation-fixedly connected to the hollow shaft **60** at the upper side of the first bearing housing **58**. At equal intermediate distances, the axes of rotation S of the conveyors **21**, **31**, **32**, **41** are in a straight line D straight below the counters **72**.

As shown in FIG. **5** the transport wheels **5** are built up by means of two transport discs **50***a*, **50***b* and a circular bottom disc **53** that are positioned straight above one another and spaced apart from each other. The transport discs **50***a*, **50***b* and the bottom disc **53** have a circular outer contour of the same diameter. The transport discs **50***a*, **50***b* in this example are each provided with ten recesses recessed from the circumferential edge **52** and evenly spread around the circumferential edge **52** and having the shape of a part of a circle, forming an even number of packaging holders **51**, wherein the packaging holders **51** of the transport discs **50***a*, **50***b* positioned above one another are straight above one another according to the vertical centre line S.

The shape and size of the packaging holders **51** is adjusted to the outer circumference of the pots **15**. For different types of pots **15** exchange sets of alternative transport wheels are available, of which the packaging holders **51** as regards shape and number are adjusted to the various types of packagings.

As shown in FIG. **4** the conveying device **73** is provided with a first toothed belt **13** that alternately engages onto opposite sides of the first toothed wheels **59**. At one outer end of the conveying device **73**, the first toothed belt **13** is coupled to a transport wheel drive unit **62** that is adapted for letting the first toothed belt **13** circulate, as a result of which the consecutive transport wheels **5** acquire a first rotation direction U and an opposing second rotation direction V that are synchronised with each other. The transport wheels **5** are synchronised such with respect to each other that during rotation two packaging holders **51** on either side of every transport wheel **5** are straight across two packaging holders **51** of consecutive transport wheels **5**. The packaging holders **51** at that moment together form several circular transfer positions A having a diameter that is suitable for confining pots **15**, wherein the transfer positions A are straight above the straight line D.

As shown in FIG. **3** the conveying device **73** is provided with two flat horizontal guide plates **16** that extend parallel to the plane of the transport discs **50***a*, **50***b*, wherein the guide plates **16** together per conveyor **21**, **31**, **32**, **41** at one side thereof comprise half a circularly curved guide edge **17** that is placed concentrically and spaced apart from the circumferential edge **52** of the discs **50***a*, **50***b*, wherein each circularly curved guide edge **17** is continued at the outer ends in a transfer guide edge **18** for guiding the pots **15** in and out during the transfer between two of the transport wheels **5**. Between the guide edges **17** or across the guide edges **17**, the guide plates **16** comprise transport disc confinement edges **80** that run parallel to the circumference of the transport discs

50*a*, 50*b*. The guide plates **16** in cooperation with the transport discs **50***a*, **50***b* thus bound a meandering guide channel **19**. The guide channel **19** forms a meandering guide path T**2** extending in the horizontal plane for guiding packagings **15** along the input, transit and output conveyors **21**, **31**, **32**, **41**.

As shown in FIGS. **2**, **3** and **4** the conveying device **73** comprises a conveyor belt **22** and a feed worm that end at the input conveyor **21**. In its longitudinal direction the feed worm **23** is positioned parallel to the conveyor belt **22**, and is at a short distance from the input conveyor **21**. The feed worm **23** is bearing mounted on the first frame **11** so as to be rotatable about its horizontal axis, wherein the diameter of the feed worm increases in the direction of the input conveyor **21**. The feed worm **23** is provided with a circumferential worm or thread of a variable pitch, wherein the diameter of the worm or thread is adjusted to the diameter of the pots **15** to take them along in it according to a horizontal rectilinear input path T**1** over the conveyor belt **22** and to the input conveyor **21**.

The conveying device **73** comprises a discharge device that is not further shown, which delivers the pots **15** after discharge from the last output conveyor **41** according to a horizontal rectilinear output path T**3**.

As shown in FIG. **1** the conveying device **73** comprises a second frame **12**, that is arranged straight below the first frame **11** and is able to shift vertically along a number of the vertical supports **8**, wherein the height of the second frame **12** can be adjusted with respect to the first frame **11** by means of a height adjustment device **79**. The conveying device **73** comprises ten slide assemblies **6**, as shown in FIG. **5** each provided with a slide axis **64** bearing mounted to the second frame **12** and extending through the hollow shaft **60** of the respective transport wheel **5** and extending below and above it. At the upper side the slide assembly **6** is provided with a slide **61**, in this example funnel-shaped, that is adapted for due to gravity receiving, passing through and discharging tablets from the dispensing module **33** positioned above the slide **61** according to a path as indicated with the arrow G. At the upper side the slide **61** comprises a first casting opening **65***a* straight below the counter **72** of the dispensing module **33** and at the lower side a second casting opening **65***b*, wherein the slide **61** is placed at an angle K to the axis of rotation S such that the second casting opening **65***b* is positioned all round straight above the circumferential edge **52** of the upper transport disc **50***a*. At the lower side the slide axis **64** is rotation-fixedly connected to a second toothed wheel **20**.

As shown in FIG. **4** the conveying device **73** is provided with a second toothed belt **14** that alternately engages onto opposite sides of the second toothed wheels **20**. At one outer end of the conveying device **73** the second toothed belt **14** is coupled to a slide drive unit **63** that is adapted for letting the first toothed belt **14** circulate, as a result of which the consecutive slides **61** acquire a third rotation direction L and an opposite fourth rotation direction M that are synchronised with each other. The slides **61** are synchronised such with respect to each other that all slides **61** have the same starting position and traverse the same distance with the lower side. Due to the various drives **62**, **63** for the transport wheels **5** and the slides **61**, respectively, the slides **61** are able to rotate independently with respect to the transport wheels **5**.

The filling device **1** is provided with an electric control unit, which is not shown, having a control program for controlling the drives **62**, **63** and the dispensing modules **33**, in order to transport pots **15** and fill them with tablets.

FIGS. **6**A-K show the process for filling the pots **15** with tablets, according to the filling device **1** shown in FIG. **1** with ten transit conveyors **31**, **32** which per transport wheel **5** are provided with ten packaging holders **51**. The conveyors **21**, **31**, **32**, **41** driven by the first toothed belt **13** rotate according to rotation directions U and V wherein two consecutive conveyors **21**, **31**, **32**, **41** rotate opposingly with respect to each other, in order to pass the pots **15** through according to the meandering guide path T**2**. FIGS. **6**A-K show successive stages of a continuous process, that can be repeated infinitely.

By way of illustration in this example fifty pots **15** are standing by at the entry to be transported and filled by the filling device **1**.

At the start of the continuous process the conveyor belt **22** and the transport wheel drive unit **62** are started and the pots **15** are supplied over the conveyor belt **22** to the input conveyor **21** that rotates in the second rotation direction V. FIG. **6**A shows the situation in which three pots **15** have already been accommodated in three packaging holders **51** of the input conveyor **21**, wherein the leading pot **15** is in the second rotation direction V one position before the first transfer position A. This is the notional starting point of the repetitive process.

Subsequently a predetermined series of five notional sub series of pots **15** is continuously entered at the first of the transfer positions A in the holders of the rotating transit conveyors **31**, **32**. The numbers of pots **15** within said sub series represent the number of pots **15** which, counted from the first of the transfer positions A, is entered in the holders of the rotating transit conveyors **31**, **32**. In this example it regards consecutively a first sub series of fourteen pots **15**, a second sub series of nine pots **15**, a third sub series of nine pots **15**, a fourth sub series of nine pots **15** and a fifth sub series of nine pots **15**. These sub series are notional as the process regards a continuous flow of pots **15**, which is only divided into notional sub series for controlling the filling of pots **15** by means of the control unit. In FIG. **6**B it is shown how according to the meandering guide path T**2** the first sub series of fourteen pots **15** has been entered into the first three transit conveyors **31**, **32** of the conveying device **73**. After entry of said fourteen pots **15** three pots **15***a* are in the transfer positions A between successively the input conveyor **21** and the first transit conveyor **31**, the first transit conveyor **31** and the second transit conveyor **32**, the second transit conveyor **32** and the next first transit conveyor **31**.

The instances shown in the separate box of FIG. **6**B show half a rotary motion of one transit conveyor **31** in the first rotation direction U, following the situation as shown in FIG. **6**B. It is visible how the slides **61**, driven by the second toothed belt **14**, during a filling time rotate a filling stroke along between a first slide position P and a second slide position Q rotation direction L or M that is the same as the rotation direction V or U, respectively, of the respective transport wheels **5**, as a result of which the slide **61** with the casting opening **65** remains straight above the opening **67** of one onwardly moving pot **15***a* in order to follow it. From the moment the slide **61** is in the first slide position P above an empty pot **15***a* in a transfer position A, the counter **72** starts dispensing tablets. The counters **72** of the respective slides **61** under which no pots **15***a* are present yet, are inactive during the filling stroke. During the filling stroke the pot **15***a* is filled via the slide **61** with a counted quantity of tablets. The degree to which the pot **15***a* is filled with tablets is indicated in the separate box of FIG. **6**B by means of black pie segments. As soon as the pot **15***a* is filled with the pre-determined quantity of tablets, wherein the full pot **15***a* is indicated by a fully black circular surface, the counter **72** ceases dispensing tablets and the slide drive **63** drives the second toothed belt **14** in opposite direction as a result of which the slide **61** rotates back to the first slide position P. Rotating back to the first slide position P ultimately takes place when the slide **61** has reached the

second slide position Q above a transfer position A, but when filling the pots **15***a* is finished sooner, it can also take place sooner.

FIG. **6**C shows how after the filling stroke of the slides **61** the pots **15***a* are filled and how the slides **61** at increased speed have returned to the first slide position P. The pots **15***a* are transported over half a stroke of the transport wheels **5** to the next upstream transfer position A of the transport wheel **5** that they are in. FIG. **6**C also shows how during the filling stroke with respect to FIG. **6**B five empty pots **15** of the second sub series of nine pots **15** have already been entered from the input conveyor **21** on the transit conveyors **31**, **32**. FIG. **6**D shows how with respect to FIG. **6**C the remaining four pots **15** of the second sub series of nine pots **15** have been entered. In total in FIG. **6**D with respect to FIG. **6**B the complete second sub series of nine pots **15** has been entered.

The number of pots **15** within this and each subsequent sub series is chosen such that after passing through the series in question all pots **15***a* passing into the transfer positions A are empty and ready for the filling stroke.

FIG. **6**D shows the situation after entering the second sub series of nine pots **15**, in which five empty pots **15***a* are in the transfer positions A. After the filling stroke, as shown in the separate box of FIG. **6**B, said pots **15***a* are filled. In that case the five counters **72** of which the respective slides **61** are positioned above the five pots **15***a* are active. The result of this filling stroke is shown in FIG. **6**E.

In FIG. **6**E five pots **15** of the third sub series of nine pots **15** have been entered. In FIG. **6**F the remaining four pots **15** of the third sub series of nine pots **15** have been entered and seven empty pots **15***a* are ready and present in the transfer positions A to be filled, wherein the seven pots **15***a* have subsequently been filled in FIG. **6**G.

In FIG. **6**G five pots **15** of the fourth sub series of nine pots **15** have been entered. In FIG. **6**H the remaining four pots **15** of the fourth sub series of nine pots **15** have been entered and ten empty pots **15***a* are ready and present in the transfer positions A to be filled, wherein the ten pots **15***a* have subsequently been filled in FIG. **6**I.

In FIG. **6**I five pots **15** of the fifth sub series of nine pots **15** have been entered. In FIG. **6**J the remaining four pots **15** of the fifth sub series of nine pots **15** have been entered and ten empty pots **15***a* are ready and present in the transfer positions A to be filled, wherein the ten pots **15***a* have subsequently been filled in FIG. **6**K.

As from the last four transit conveyors **31**, **32** during the steps shown in FIGS. **6**A-K all pots **15** have been filled, after subsequently entering the sub series of fourteen, nine, nine, nine and nine pots **15** and the filling of the pots **15***a* within these continuously moving sub series. The first, second, third, fourth and fifth sub series together form a series, that can be repeated infinitely. In the process that is shown in the FIGS. **6**A-K there is no repetition of the series, as a result of which the filling device **1** after passing through the fifty pots **15** empties. When repeating the process, that means repeatedly entering the series, there is a continuous flow of pots **15** through the filling device **1**. The already filled pots **15***a* in the last transit conveyors **31**, **32** as a result of said newly entered series are discharged via the output conveyors **41**.

When the pots **15***a* are not completely filled at the second slide position Q, for instance due to a large quantity of bulk goods to be poured per pot **15***a*, the rotation speed of the transport wheels **5** and the swivelling speed of the slides **61** needs to be adjusted, so that the filling time becomes longer.

When programming the control unit the number of pots **15** in the consecutive sub series of the repetitive series are chosen such that the pots **15***a* in the transfer positions A after entering a sub series are empty and ready to be filled with tablets that are supplied by the slides **61**. The numbers in the sub series depend on the number of transit conveyors **31**, **32** and the number of packaging holders **51** of the transport wheels **5**, wherein the dependency can be described on the basis of six conditions:

i) to all series applies that the number of sub series within the repetitive series is determined by dividing the number of packaging holders **51** of one transport wheel **5** by two.

ii) the overall number of pots **15** of the repetitive series equals the number of packaging holders **51** of one transport wheel **5** multiplied by the number of transit conveyors **31**, **32** divided by two.

iii) if the number of sub series is an even number and if the number of transit conveyors **31**, **32** is an even number, then the sub series each consist of a number of pots **15** equaling the overall number of pots **15** minus the number of sub series within the series divided by the number of sub series within the series, wherein a number of packagings equaling the number of sub series within the repetitive series is added to the first sub series of the series.

iv) if the number of sub series is an odd number and if the resulting number of a division of the number of transit conveyors **31**, **32** by the number of sub series within the series results in an integer, the sub series each consist of a number of pots **15** equaling the overall number of pots **15** minus the number of sub series within the repetitive series, overall divided by the number of sub series within the repetitive series, wherein a number of packagings equaling the number of sub series within the series is added to the first sub series of the series. That is why in the example above there is question of a repetitive series consisting of five sub series of fourteen, nine, nine, nine and nine pots **15**, respectively.

v) in all other cases with an even number of packaging holders **51** the sub series each consist of a number of pots **15** equaling the overall number of pots **15** of the repetitive series divided by the number of sub series within the series.

FIGS. **7**A and **7**B show an alternative conveyor, comprising a first bearing housing **158** that is fixedly connected to the first frame **11**, a hollow shaft **160** bearing mounted within the bearing housing **158** and having a vertical centre line and axis of rotation S, a toothed wheel **159** that is rotation-fixedly connected to the hollow shaft **160** at the lower side of the first bearing housing **158** and an electromagnetic transport wheel support **156** that is rotation-fixedly connected to the hollow shaft **160** at the upper side of the first bearing housing **158**. The alternative conveyor comprises a transport wheel **105** that is provided with a transport disc **150** and a substantially circular bottom disc **153**. At the side facing away from the transport disc **150** the bottom disc **153** is provided with a circular cavity **154**, with which the bottom disc **153** can be electromagnetically connected to an electromagnetic transport wheel support **156**. The cavity **154** and the electromagnetic transport wheel support **156** are provided with a first index surface **155** and a second index surface **157**, respectively, that together form an index for unambiguous attachment of the transport wheel **5** to the electromagnetic transport wheel support **156** for synchronisation. Due to the electromagnetic forces the transport wheel **5** is immediately locked after placement. The transport disc **150** and the bottom disc **153** are integrally manufactured.

The above description is included to illustrate the operation of preferred embodiments of the invention and not to limit the scope of the invention. Starting from the above explanation many variations that fall within the spirit and scope of the present invention will be evident to an expert.

The invention claimed is:

1. A filling device for filling packagings with counted bulk goods, comprising

a dispenser having several dispensing units provided with a counter for counted dispensation of the bulk goods to the packagings and a conveying device for transport of the packagings with respect to the dispensing units,

wherein the conveying device is provided with several consecutive transport wheels and a transport wheel drive for mutual opposite rotation of the immediately consecutive transport wheels,

wherein the transport wheels each have a first axis of rotation and several packaging holders spread around the circumference of the transport wheel,

wherein the transport wheels are positioned in each other's vicinity at the location of the packaging holders and with the axes of rotation parallel to each other for the transfer of packagings between packaging holders at a mutual transfer position between the immediately consecutive transport wheels during the opposite rotation for obtaining a meandering conveyance path of the packagings with respect to the dispensing units,

which path is constituted of opposite arch segments,

wherein the conveying device is provided above at least a part of the transport wheels with a slide per transport wheel, which slide is positioned at a slant and has a second axis of rotation and a lower exit for the transfer of counted bulk goods from the dispensing units to the packagings,

wherein the conveying device comprises a slide drive for mutual opposite rotation of the immediately consecutive slides in accordance with the transport wheels, such that the lower exit follows a packaging moving away from the transfer position, which packaging is in the packaging holder of said transport wheel.

2. The filling device according to claim 1, wherein consecutive transfer positions between consecutive transport wheels are situated on a first straight line.

3. The filling device according to claim 2, wherein the first axes axis of rotation of each consecutive transport wheel is situated on a second straight line.

4. The filling device according to claim 3, wherein the first line and the second line coincide with each other.

5. The filling device according to claim 1, wherein the first axes of rotation are substantially vertically oriented and the meandering conveyance path extends in a substantially horizontal straight plane.

6. The filling device according to claim 1, wherein the packaging holders coming together at the transfer position enclose a packaging on both sides.

7. The filling device according to claim 1, wherein the transport wheels have an outer circumference situated on a circle at which outer circumference the packaging holders are situated.

8. The filling device according to claim 1, wherein the transport wheels are detachably magnetically connected to or magnetically locked with respect to the transport wheel drive.

9. The filling device according to claim 8, wherein the transport wheel drive comprises a transport wheel support having an electromagnet that can be switched on and off for connecting or locking the transport wheels with respect to the transport wheel drive.

10. The filling device according to claim 1, wherein the transport wheel drive is adapted for synchronized opposite rotation of the immediately consecutive transport wheels at the same speed of revolution and per revolution with the same packaging holders at the transfer position.

11. The filling device according to claim 1, wherein the first and second axes of rotation coincide with each other.

12. The filling device according to claim 1, wherein the slide drive is adapted for synchronized opposite rotation of the immediately consecutive slides in accordance with the transport wheels at the same speed of revolution and with the same starting position with respect to the transfer position.

13. The filling device according to claim 1, wherein the height of the lower exit of the slide is adjustable with respect to the packaging holders.

14. The filling device according to claim 1, wherein the conveying device at the location of one or several last transport wheels is provided with a separation device for removing disapproved packagings from the meandering path.

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